CORRELATION OF STRUCTURE AND MAGNETISM IN NOVEL NANOSCALE MAGNETIC PARTICLES

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Summary

In this network consisting of 10 European laboratories a novel interdisciplinary approach to the fabrcation and characterization of nanoscale magnetic particles (5-15 nm) is taken. Quasi-two dimensional arrays of magnetic (3d metals) particles will be prepared by drying of thin layers of colloidal suspensions (magnetorheological fluids) in large magnetic fields. The preparation of monodisperse particles with a silicon coating layer of different thickness is feasible. Magnetic properties of these particle arrangements like exchange interaction, magnetic anisotropy, Curie temperature and magnetoresistance will be controlled by modifications of the substrate (lithographically or by ion beam etching) , by control of the thickness of the coating layer of the individual particle, and by the choice of the ferro- or paramagnetic capping layer of the array. We propose an innovative approach to a cost-efficient fabrication of nanoscale particles which have offer long-term magnetic stability and minimum domain size for magnetic storage or magnetoresistive application. This is of obvious technological and industrial relevance. Furthermore modifications of the magnitude of the magnetic moment, of the ratio of interface/bulk magnetic moments, likely enhancements of the orbital contribution to the magnetic moment will be quantified. The measurement of these microscopic magnetic properties and the correlation with the detailled analysis of the crystalline structure has a direct impact on the understanding and control of technological relevant parameters like storage density and stability of stored magnetic data. One may also expect to develop new concepts for magneto-electronic devices based on nanomagnetic particles coated with a semiconductor layer.